A ceraphronid wasp in Early Miocene amber from the Dominican Republic (Hymenoptera: Ceraphronidae)

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2013

Novitates Paleoentomologicae

No. 2, pp. 1–6 4 September 2013

A ceraphronid wasp in Early Miocene amber from the Dominican Republic (Hymenoptera: Ceraphronidae)

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Abstract. The first fossil of the parasitoid wasp family Ceraphronidae (Ceraphronoidea) is described and figured. ***Ceraphron ceuthonymus*** Engel, new species, is described from Early Miocene (Burdigalian) amber from the Dominican Republic and distinguished from its close congeners. A brief summary of the fossil record of Ceraphronoidea is provided.

INTRODUCTION

The Ceraphronoidea are one of the Lilliputian lineages of apocritan parasitoid wasps. The approximately 800 described species range in size from about 0.5–4 mm found throughout the world. Species are parasitoids or hyperparasitoids of diverse insect hosts, ranging across the Hemiptera, Thysanoptera, Neuroptera, Mecoptera, Diptera, Lepidoptera, and Trichoptera (*e.g.*, Cooper & Dessart, 1975; Fergusson, 1980; Dessart, 1995; Luhmann *et al.*, 1999). This diversity is segregated into two families, Ceraphronidae and Megaspilidae, with the latter split into two subfamilies, the primitive Lagynodinae and the nominate Megaspilinae. While much alpha taxonomic work has been undertaken on the family, largely through the efforts of the late Paul Dessart (1931–2001) (Pauly, 2001), extensive systematic study across the superfamily has only begun in earnest (*e.g.*, Mikó & Deans, 2009). The superfamily has a meager fossil record but the limited evidence does demonstrate that the lineage extends well into the Cretaceous and two extinct families are presently recognized from the Mesozoic (*e.g.*, Kozlov, 1975; Alekseev & Rasnitsyn, 1981; Engel & Grimaldi, 2009; Ortega-Blanco *et al.*, 2010; McKellar & Engel, 2011). At the time of its discovery 50 years ago, *Allocotidus bruesi* Muesebeck was considered a Cretaceous example of Ceraphronidae (Muesebeck, 1963), but this Cenomanian Alaskan amber specimen was subsequently recog-

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ISSN 2329-5880

nized as belonging to the closely allied Cretaceous family Stigmaphronidae (Kozlov, 1975). Cladistic analysis of Stigmaphronidae has supported this placement (Engel & Grimaldi, 2009), leaving Ceraphronidae without any known fossil exemplars until now.

Herein is described the first fossil of the family Ceraphronidae based on a single individual preserved in Early Miocene (Burdigalian) amber from the Dominican Republic. The species is of the large, worldwide, and heterogeneous genus *Ceraphron* Jurine and is distinguished from its congeners

MATERIAL AND METHODS

The specimen described herein is situated deep within a piece of clear, pale yellow amber and is not obscured from view by other inclusions or debris. Various syninclusions do make it impossible to prepare the amber closer to the ceraphronid and this renders its study somewhat difficult but clear views are nonetheless possible from both sides (Figs. 1–2). The age and origin of Dominican amber has been reviewed by Iturralde-Vinent & MacPhee (1996, 1999) and Grimaldi & Engel (2005), while the insect fauna was most recently catalogued by Arillo & Ortuño (2005), although that work is now largely out of date. Photomicrographs were taken with a Canon 7D digital camera attached to an Infinity K-2 long-distance microscope lens and illuminated with a Xenon flash, while measurements were taken with an ocular micrometer attached to an Olympus SZX-12 stereomicroscope.

SYSTEMATIC PALEONTOLOGY

Family Ceraphronidae Haliday
Genus *Ceraphron* Jurine
Ceraphron ceuthonymus Engel, new species
ZooBank: urn:lsid:zoobank.org:act:65B176AD-06BD-40C5-A699-3003DBE66805
(Figs. 1–2)

DIAGNOSIS: The new species is distinguished by the following combination of features: deep chestnut brown coloration; wings without patterns of infuscation; subglobulose head with large compound eyes; scape length three times width, cylindrical; relative proportions of antennomeres (flagellomere I 0.05 mm: II–VIII each 0.03 mm: IX 0.07 mm); concolorous antennomeres; and exceedingly minute size (body length less than 1 mm).

DESCRIPTION: ♂: Total body length 0.63 mm; forewing length 0.67 mm. Integument of head, mesosoma, and metasoma deep chestnut brown, antenna brown, mouthparts and legs brownish yellow. Head subglobulose, wider than long, distance between inner border of compound eyes apparently greater than compound eye length, integument strongly imbricate. Compound eyes prominent, occupying majority of lateral profile of head; gena very narrow; occiput broadly rounded, without occipital depression. Median ocellus set just below dorsal tangent of compound eyes; median ocellus separated from lateral ocellus by about one ocellar diameter; lateral ocellus separated from ocular border by nearly four times ocellar diameter. Antennal toruli situated ventrally below lower tangent of compound eyes; antenna geniculate, with 11 antennomeres, each approximately 0.03 mm wide; scape cylindrical, with distinct imbricate sculpture, length 0.09 mm; pedicel length 0.04 mm; flagellomere I length 0.05 mm,

Figures 1–2. Photomicrographs of holotype (SEMC-F001022) of *Ceraphron ceuthonymus*, new species, in Early Miocene amber from the Dominican Republic. **1.** Lateral view. **2.** Dorsal oblique view.

flagellomeres II–VIII each with length 0.03 mm, flagellomere IX length 0.07 mm; flagellomeres with scattered minute, subappressed setae. Mesosoma slightly longer than high, with sparsely scattered, minute, suberect setae. Mesoscutum wider than long, with median line impressed, continuous, notauli absent; transverse mesoscutal sulcus strongly impressed, integument weakly imbricate; axillae large, scarcely touching medially along mesoscutal transverse sulcus (*i.e.*, interaxillar sulcus minute), separated from mesoscutellum by deeply impressed but simple (*i.e.*, not areolate) mesoscutal-mesoscutellar sulci; mesoscutellum large, slightly longer than wide, apical border rounded to form medial point, medial apex slightly overhanging propodeum, integument apparently as on mesoscutum; metanotal-propodeal sulcus apparently foveolate;

propodeum almost entirely declivitous. Forewing hyaline, clear, without patterns of infuscation, membrane with numerous microtrichia, greatly surpassing metasomal apex, veins light brown, margin with fringe of short, erect setae; venation represented by C+Sc+R, linear pterostigma (considered "absent" in literature but merely reduced in Ceraphronidae to a single section of R along anterior wing margin demarcated basally by a bulla), and r-rs (perhaps actually r-rs+Rs); bulla present between C+Sc+R and linear pterostigma along wing margin; pterostigma reduced, linear, length about 5 times width; r-rs originating in apical fifth of pterostigma; r-rs gently arched, tubular for its entire length, terminating before wing apex and separated from apical margin by distance about 0.86 times its length; hind wing without venation, nearly as long as forewing. Protibial spur simple; single mesotibial spur present; two metatibial spurs present; metabasitarsus about as long as combined lengths of remaining tarsomeres; pretarsal claws apparently simple. Metasoma without anterior, tapering 'neck'; syntergite massive, much longer than combined lengths of remaining terga, remaining metasomal segments significantly smaller, transverse, and largely obscured; metasoma apparently minutely and finely shagreened.

♀: Unknown.

HOLOTYPE: ♂, SEMC-F001022, Early Miocene amber from the Dominican Republic (specific mine unknown); deposited in the Division of Entomology, University of Kansas Natural History Museum, Lawrence, Kansas.

ETYMOLOGY: The specific epithet is taken from the Greek mythological figure Keuthonymos, father of Menoetes and spirit of Hades.

DISCUSSION

Although the superfamily Ceraphronoidea has a geological record extending into the Early Cretaceous (Rasnitsyn, 1991; Engel & Grimaldi, 2009; Ortega-Blanco *et al*., 2010, 2011), and likely even further, definitive ceraphronids have until now remained undescribed as fossils (McKellar & Engel, 2011). Nearly all of the Mesozoic records are assigned to the extinct family Stigmaphronidae (Kozlov, 1975; Rasnitsyn, 1991; Engel & Grimaldi, 2009; Ortega-Blanco *et al*., 2011; McKellar & Engel, 2011), although two species are placed in a related extinct family Radiophronidae (Ortega-Blanco *et al*., 2010) and three are clearly of the Megaspilidae (Alekseev & Rasnitsyn, 1981; McKellar & Engel, 2011; Perrichot, in press). The previous Tertiary records are all of the Megaspilidae and include mostly amber inclusions from the Baltic (Brues, 1940; Dessart, 1977, 1978, 1987; Szabó & Oehlke, 1986; Alekseev, 1995) but also a finely preserved compression in oil shale from Rubielos de Mora Basin, Spain (Peñalver & Engel, 2006). Some of the recognized ceraphronoid genera are quite heterogeneous, such as *Conostigmus* Dahlbom, into which the majority of fossil megaspilids are classified (McKellar & Engel, 2011). It is likely that several genera will either need to be united, creating unwieldy taxonomic entities, or groups such as *Conostigmus* should be split into more natural lineages. Should such actions be taken it is likely that several of the fossil *Conostigmus* will require placement in other, perhaps even new, groups. At a higher level, given that megaspilids are not assuredly monophyletic and that Ceraphronidae may derive from somewhere therein, it may not be all that surprising that ceraphronids have not previously been recovered as fossils and certainly not from more ancient deposits. Indeed, it is within the realm of possibility that Ceraphronidae is a Tertiary radiation from among a paraphyletic Megaspilidae. The traditional characters used to circumscribe the Megaspilidae are all potentially plesiomorphic relative

to Ceraphronidae, particularly when placed in comparison with Stigmaphronidae and Radiophronidae. For example, many ceraphronid traits are reductions (*e.g.*, female with 8 antennomeres, presence of single mesotibial spur) from states otherwise observed in Megaspilidae and the extinct families, or are clearly apomorphic novelties relative to these same families (*e.g.*, presence of Waterston's organ, reduced and linear forewing pterostigma). Perhaps in line with this is the discovery of a species that seemingly intermingles some of the traditional character combinations for the two families, further highlighting megaspilids *s.l.* as potentially being stem Ceraphronidae (Mikó & Deans, 2009). As the phylogeny and classification of Ceraphronoidea is clarified and refined it may be worthwhile to consider incorporating megaspilids into an expanded Ceraphronidae, treating them as essentially stem ceraphronids. Hopefully, by such time there will be an ample wealth of ceraphronid and megaspilid fossils available from a diversity of ages and localities, so that a finer perspective on relationships and the episodes of diversification will contribute greatly to such a system.

ACKNOWLEDGEMENTS

I am grateful to two reviewers for their comments on the manuscript. This paper is dedicated to Paul Dessart (1931–2001), who extended great kindness and enthusiasm to me and shared many reprints with me when I first became fascinated by the Ceraphronoidea in the late 1990s. Partial support for this work was provided by U.S. National Science Foundation grant DEB-0542909 (to M.S.E.). This is a contribution of the Division of Entomology, University of Kansas Natural History Museum.

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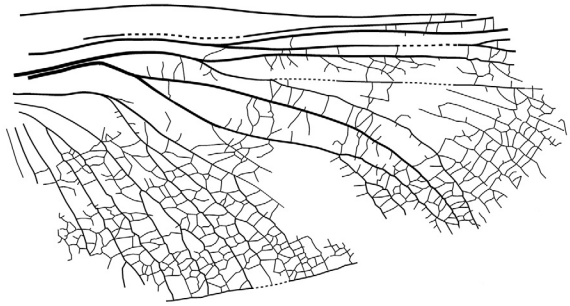

Pharciphyzelus lacefieldi Beckemeyer & Engel, 2011

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Novitates Paleoentomologicae was established at the University of Kansas through the efforts of Michael S. Engel, Jaime Ortega-Blanco, and Ryan C. McKellar in 2013 and each article is published as its own number, with issues appearing online as soon as they are ready. Papers are composed using Microsoft Word® and Adobe InDesign® in Lawrence, Kansas, USA.

Novitates Paleoentomologicae is registered in ZooBank (www.zoobank.org), archived at the University of Kansas and in Portico (www.portico.org), and printed on demand by Southwestern Oklahoma State University Press.

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ISSN 2329-5880